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STORAGE DEVICE

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Fig. 1.

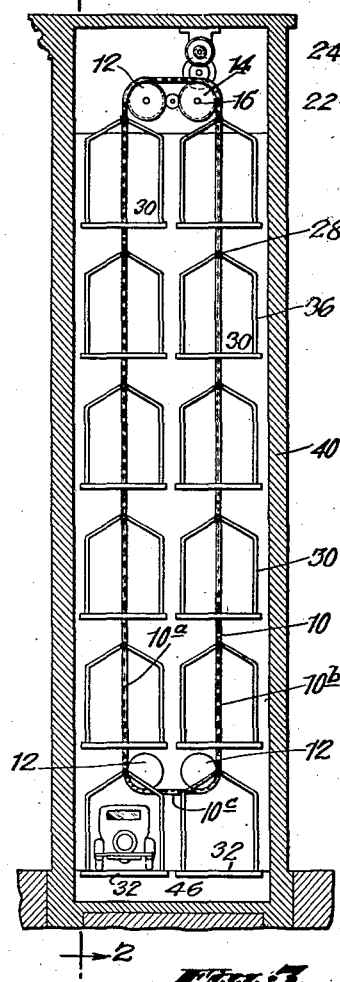


Fig. 2.

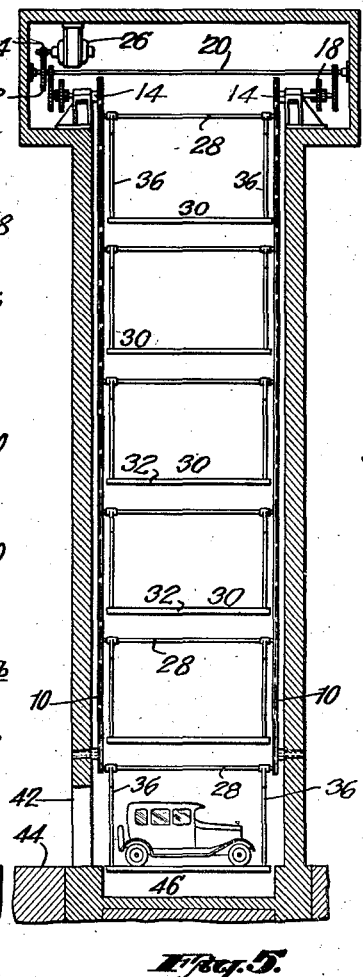


Fig. 4.

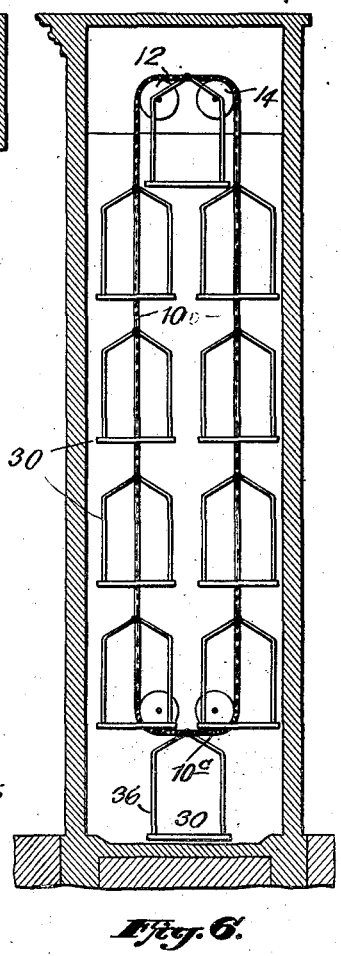


Fig. 3.

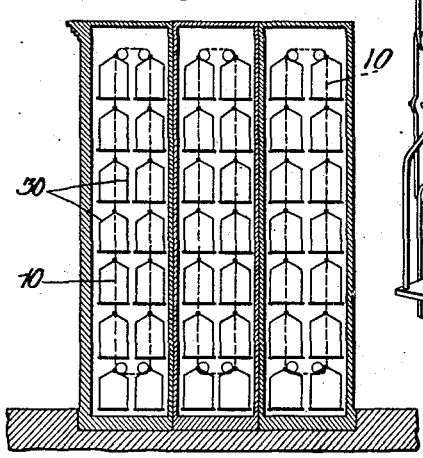


Fig. 5.

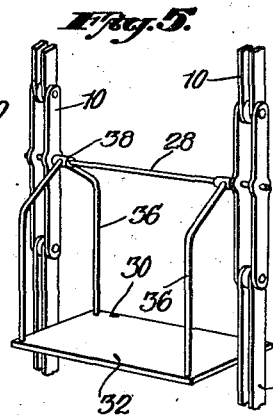
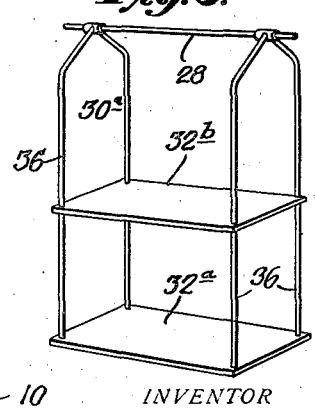


Fig. 6.



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STORAGE DEVICE

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Fig. 7.

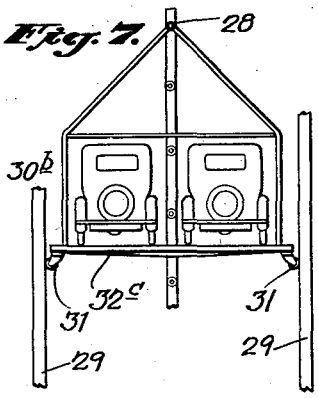


Fig. 8.

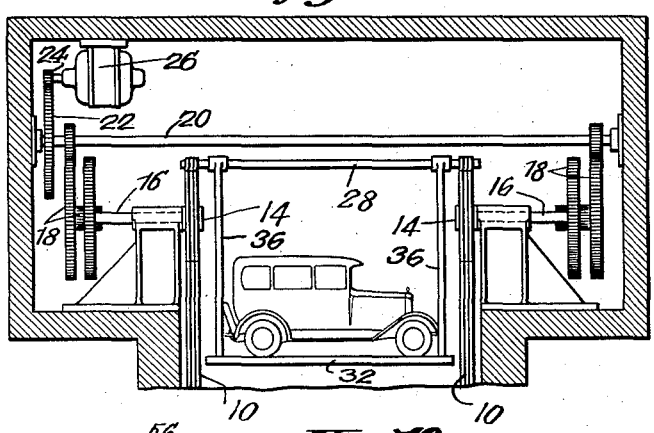


Fig. 9.

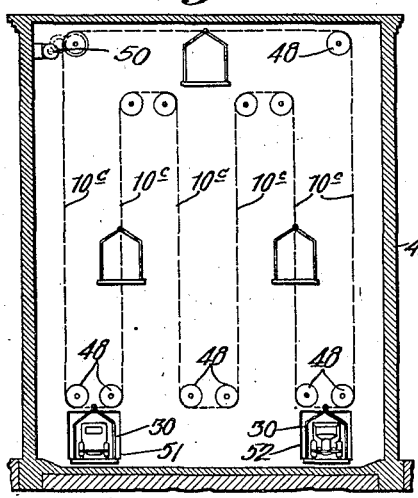


Fig. 10.

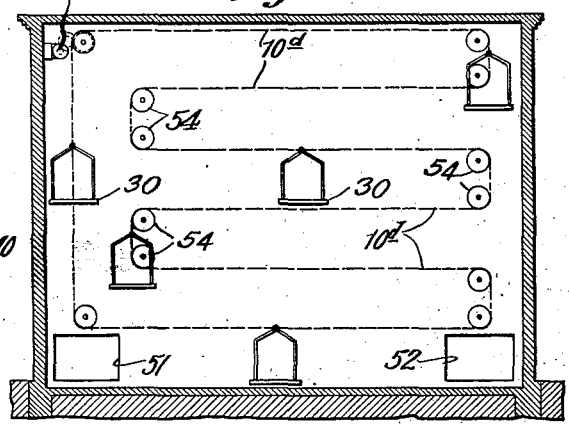


Fig. 11.

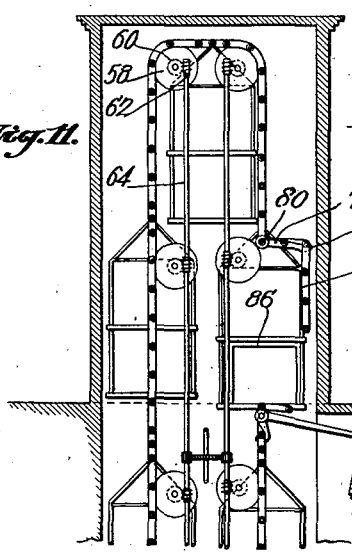


Fig. 12.

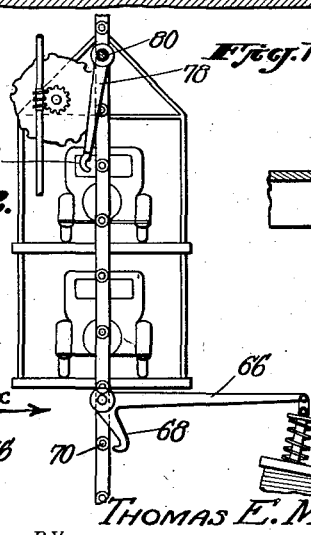
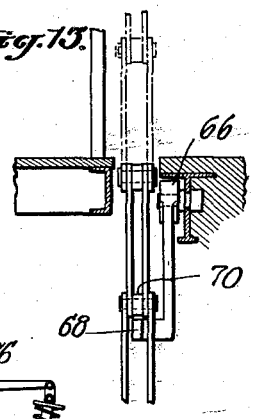


Fig. 13.



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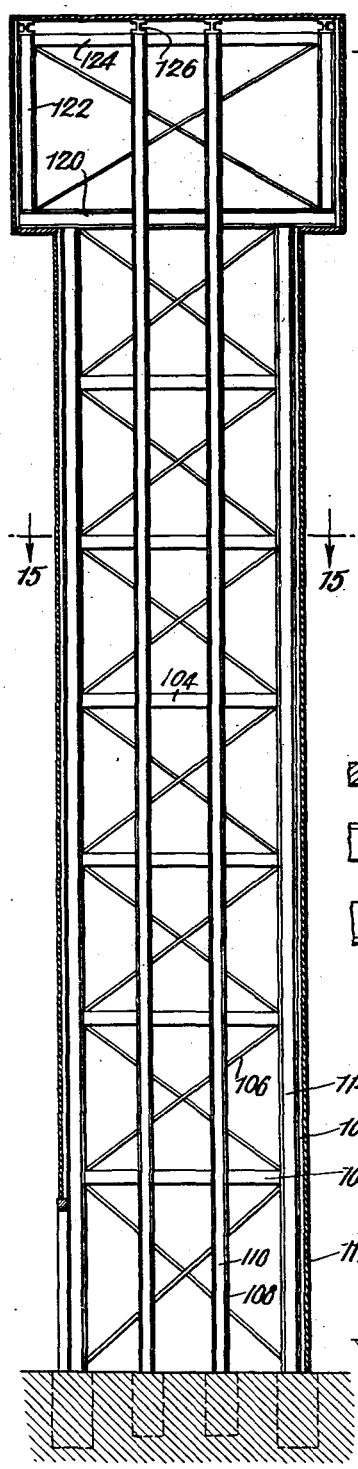


Fig. 15.

Fig. 16.

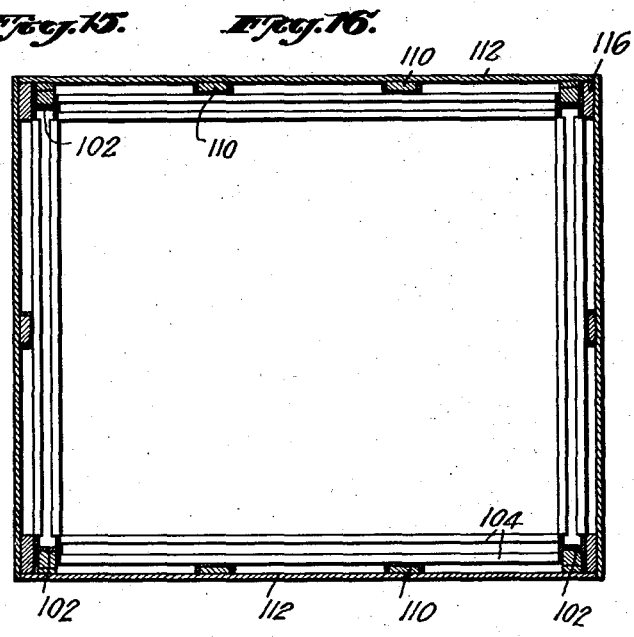


Fig. 17.

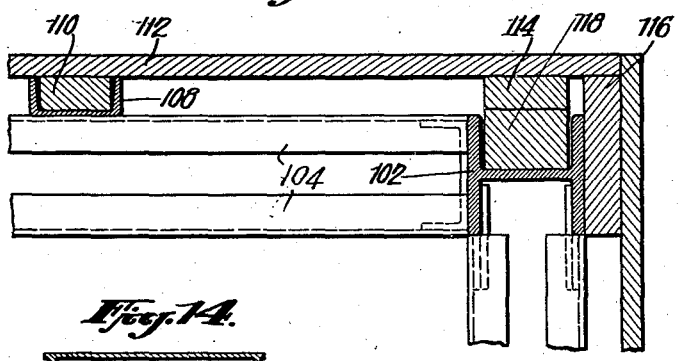


Fig. 14.

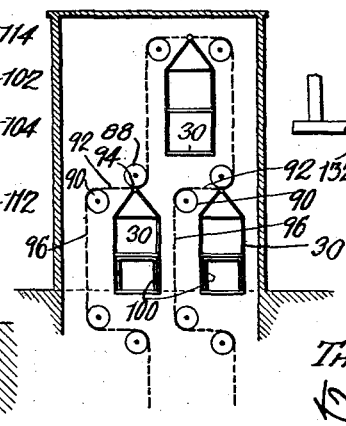
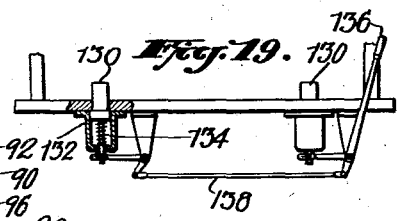


Fig. 19.



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STORAGE DEVICE

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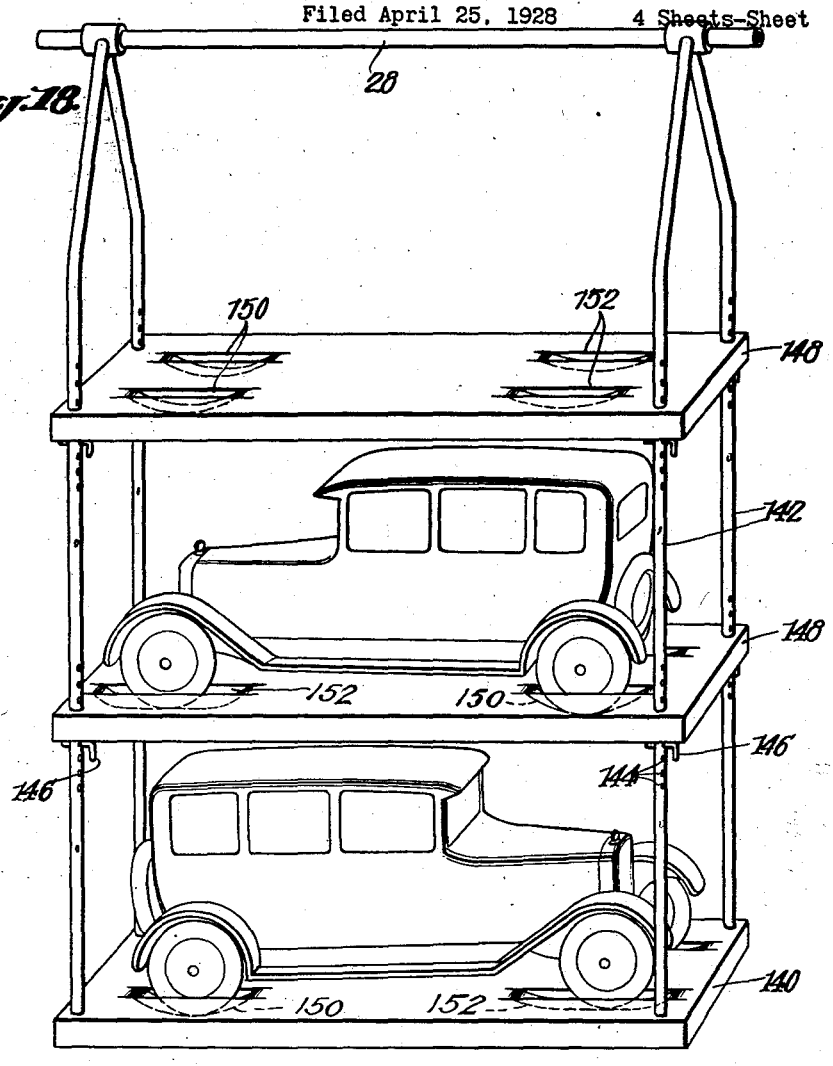
Fig. 18.



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UNITED STATES PATENT OFFICE

THOMAS E. MURRAY, OF BROOKLYN, NEW YORK; JOSEPH BRADLEY MURRAY, THOMAS E. MURRAY, JR., AND JOHN F. MURRAY, EXECUTORS OF SAID THOMAS E. MURRAY, DECEASED, ASSIGNORS TO METROPOLITAN ENGINEERING COMPANY, A CORPORATION OF NEW YORK

STORAGE DEVICE

Application filed April 25, 1928. Serial No. 272,577.

This invention relates to an improved storage device which while not limited thereto is particularly adapted for use in storing in a comparatively small space a great number of automobiles.

In recent years the number of automobiles in daily use has increased to such an extent that the difficulty of finding a parking place in most large cities is becoming a recognized condition. Moreover, where traffic is heavy the parking of cars on many streets is prohibited. It is highly probable that in many congested areas there is insufficient provision for the housing of automobiles. Where the same have to be stored in garages having several storage floors considerable time is lost in handling cars on elevators or driving them about and placing them on the different floors. In those storage buildings in which cars ascend to the different stories on inclined ramps, much valuable space is needed for the runways and time is lost in stowing cars away on the different floors.

My invention aims to overcome the above difficulties and aims to provide one or more units each made up of a series of cages adapted to hold one or more automobiles, these cages being suspended from a flexible member such as a chain, cable or the like which is adapted to be driven by a suitable transmission mechanism as will hereinafter appear.

The invention will be fully understood from the following specification when read in connection with the accompanying drawings and will be pointed out with particularity in the appended claim. In the drawings—

Fig. 1 is a vertical section through an enclosing structure such as a building or tower and illustrating one embodiment of my invention;

Fig. 2 is a vertical section on line 2—2 of Fig. 1;

Fig. 3 is a diagrammatic view illustrating a plurality of units similar to that of Fig. 1;

Fig. 4 is a view similar to Fig. 1 showing a slightly different arrangement of the supporting cages;

Fig. 5 is a detail view showing a cage adapted to hold a single automobile and also illustrating the chain carrier for the cage;

Fig. 6 is a detail perspective view of a modified form of cage adapted to hold a plurality of automobiles one over the other;

Fig. 7 is a modified form of cage adapted to hold two automobiles side by side;

Fig. 8 is an enlarged detail of the upper portion of Fig. 2 illustrating the mechanism for moving the cages;

Fig. 9 is a diagrammatic view showing a modified arrangement;

Fig. 10 is a diagram illustrating a further modification in the arrangement of the cage carrying chain;

Fig. 11 is a sectional elevation illustrating a modified arrangement;

Fig. 12 is an enlarged detail of part of the apparatus shown in Fig. 11;

Fig. 13 is an end view of the lower part of Fig. 12 viewed in the direction of arrow 13x;

Fig. 14 is a diagrammatic view illustrating an arrangement for permitting the loading of cars without interference with the cage supporting chains;

Fig. 15 is a detail view of a suitable steel frame work or supporting structure for the mechanism of Figs. 1 and 2;

Fig. 16 is a horizontal section on line 16—16 of Fig. 15;

Fig. 17 is an enlarged detail view of the upper right-hand corner of Fig. 16;

Fig. 18 is a detail of a stop device for preventing over travelling of a car on a cage;

Fig. 19 is a perspective detail showing a modified form of car carrying cage.

Referring first to the embodiment of the invention illustrated in Figs. 1 and 2 of the drawings, I provide a pair of sprocket chains 10—10 trained over a series of idler wheels or sprockets 12 and over a drive sprocket 14. Each sprocket 14 is carried on a shaft 16 adapted to be driven through gearing 18 and a cross-shaft 20 carrying a gear 22 meshing with a driving pinion 24 carried on the armature shaft of a motor 26.

At substantially equally spaced intervals chains 10—10 support cross-members 28 from

which are suspended cages 30 each of which is adapted to hold an automobile.

Each cage comprises a floor portion 32 and upright hangers 36 having bearings 38 pivotally engaging cross-members 28. In Figs. 1 and 2 I have shown a tower-like enclosure or building 40 having an entrance opening or doorway 42 at the street level 44. A pit 46 is provided in the construction of Figs. 1 and 2 so as to provide clearance for the cages as the chain is moved. As indicated in Fig. 1, a pair of cages can be simultaneously loaded at the street level because of the spacing of the two runs 10^a and 10^b of the chain and the lateral spacing of the lower idler sprockets 12. In this arrangement each cage is suspended from part of the chain at an elevation higher than the lower run 10^c. Hence, the necessity of providing a pit 46 giving clearance to allow the cages to freely round the turn.

In the arrangement of Fig. 4 the lowermost cage is adapted to be loaded substantially at the street level and while loading it is supported by the lower run 10^c. In this arrangement, of course, only one cage can be loaded at a time, whereas, in the arrangement of Fig. 4, two cages can be simultaneously loaded or one can be loaded while the other is discharging.

Fig. 3 diagrammatically shows three storage units each made up of a series of cages 30 carried by chains 10 and illustrates the compact manner in which a multiplicity of cars can be stowed away in a small space. A single building or storage compartment 40 may, of course, accommodate a multiplicity of units of the kind shown in Fig. 1.

Instead of each cage carrying one car, I may provide an arrangement as shown in Fig. 6 in which the cage 30^a is of greater height than that shown in Fig. 5. This cage 30^a is provided with a lower floor 32^a and an upper floor 32^b each adapted to support a single automobile, the cage being arranged for suspension from a cross-member 28. Similarly, three or more floors per cage may be provided.

Or, as illustrated in Fig. 7, the cage 30^b may be provided with a floor 32^c of sufficient width to accommodate two cars side by side. In this arrangement the cars supported are of substantially the same weight and will approximately balance about the supporting member 28. However, fixed guides 29 may be provided for coaction with rollers 31 secured to the cage so as to prevent swinging of the cage about its supporting member 28.

In the arrangement of Figs. 1, 2 and 4, it will be seen that the car-loading level is below the lowermost run 10^c of the chain, thus providing a clear space between the suspension members 36. As the chain is moved to lift the cages it is clear that the latter are brought to positions in which the chain itself forms an obstruction both in front and in back of the car. In the arrangement of Fig. 7, the floor of the cage is of such width that the supporting chain 10 forms no obstruction and the cars can, therefore, be loaded at any desired level. Of course, during loading, the side guides 29 prevent rocking of the cage about the pivotal hanger 28.

Instead of supporting the car carrying cages on the simple run of chains as in Figs. 1 and 4, I may provide a plurality of guide idlers 48 as in Fig. 9, the entire system being driven by one or more motors or other drive mechanism indicated diagrammatically at 50. With this arrangement a plurality of chain runs 10^c are provided so that a great number of car supporting cages can be accommodated in the single enclosing structure 40. In this arrangement, cars will preferably be loaded through one doorway 51 of the building and will be unloaded through the doorway 52.

Fig. 10 shows a further alternative arrangement in which the several runs of chain 10^d are disposed horizontally and guided on idlers 54, the chains being driven by a common motor 56.

In some cases it is desirable to provide for storing a great number of cars in a shaft below the street level. This necessitates providing means to permit a car to drive in endwise of the cage 30. But a difficulty here is met by the fact that the cage is suspended on the center line of the chain, it being considered desirable to have the car so oriented on the cage that the longitudinal center line of the car is substantially in alignment with the center line of the cross-member from which the cage is pivotally supported. This is desirable because if the longitudinal center line of the car lies in substantially the same vertical plane as the center line of the pivotal support for the cage, the load will automatically balance. This is true because the weight on each side of the longitudinal center line of the present-day automobile is substantially equal. On the other hand, the weight in the front part of a car is much greater than that in the rear because of the location of the engine or power plant. Thus, the preferred arrangement is one in which the cage is hung from a member carried by chains, such member being above the lengthwise center line of the cage floor. Where the cars are to be stowed away below the street level, it is, therefore, necessary to provide a simple arrangement whereby the car to be loaded can pass the supporting chain. One such arrangement is shown in Figs. 11 and 12.

In Fig. 11 the supporting chain is driven by sprockets 58 carrying worm wheels 60 driven by worms 62 from the shafts 64 which obtain their power from any suitable drive. The worms being self-locking permit the

chain to be uncoupled without danger of the load on the cages pulling the chain.

Where cars are to be stored below the entrance level, the chain is first locked by means to be described and then uncoupled so as to permit the car to be driven onto the cage. To hold the slack chain during the loading, I provide a bell crank 66 having a hooked end 68 adapted to catch under a cross-stud 70 of the chain, this bell crank being operated by closing a circuit 72 through a solenoid 74 by means of a control switch 76. On energization of the solenoid, the hook 68 will catch under the stud 70 of the supporting chain and support the cages therebelow. The movement of the hook 68 is intended to exert sufficient lifting action on the studs 70 to take up slack so as to facilitate uncoupling of the chain. For moving the slack end of the chain out of the way, I provide an arm 78 carried by a stud 80. This arm when rocked to the position of Fig. 11 will cause the hooked end 82 thereof to lift the free uncoupled end 84 of the chain out of alignment with the center of the cage and thus permit a car to be loaded through the entrance doorway 86 without interference with the supporting chain.

Instead of breaking the joint in the length of the chain to permit loading or discharge of cars from the cages, I may provide idlers which are so arranged that the chain will have a lateral travel at certain points as indicated in Fig. 14. As here shown I provide idlers 88 and 90 so arranged that a lateral run of chain 92 is provided.

The spacing of the idlers is such that, for example, when the supporting member for a cage indicated by the point 94 reaches the position shown in Fig. 14, the remaining run of that part of the chain indicated at 96 will be offset from the center of the cage 30 so as to permit the car to be loaded through either doorway 100 without interference with the supporting chain.

From the foregoing description, it is clear that my improved apparatus provides means whereby a great number of automobiles can be stored away in a comparatively small amount of space without the necessity of manipulating the cars. The load on the opposite runs of the cage carrying chains is substantially or approximately balanced and, therefore, a minimum amount of power is required for driving the same. The floors or supporting platforms of the car carrying cages are preferably rectangular in cross-section and the cage is preferably so suspended from the chain that the center line of the platform is in alignment with the center of the chain. This is desirable because the car being driven onto the platform will substantially line up centrally with the supporting member which is centered with the chain. Thus, as the chain travels around the load will be balanced and the cage and car thereon will hang plumb. However, guides similar to those shown at 29 in Fig. 7 may be used to prevent rocking of the cages.

While the drawings and descriptions refer to chain for supporting the cages, it is clear that I may substitute, therefore, a cable or similar flexible cage carrying member.

Figs. 15, 16 and 17 illustrate a suitable enclosing structure for the apparatus. This structure includes a skeleton frame work composed of a plurality of uprights 102 connected at different elevations by suitable beams or girders 104 braced by truss members 106. A plurality of upright channels 108 are provided and these carry nailing strips 110 by means of which any suitable siding or sheathing 112 can be secured in place. The corner columns or uprights 102 also carry nailing strips 114 and 116, the strips being secured to spacer blocks 118 bolted or otherwise fastened to the webs of the uprights 102. At the top or near the roof of the structure, cross-girders 120 are provided and these support uprights 122 and cross-beams 124 carrying roof purlins 126. This upper structure is adapted to support the motor and transmission mechanism for actuating the cage carrying chains.

In Fig. 18 I have illustrated a car supporting storage cage including a lower supporting floor 140 to which are secured the corner upright suspension members 142 carried by a cross member 28 adapted to be secured to a chain such as that shown in the other figures of the drawings. The uprights 142 are provided at spaced intervals with cross holes 144 for the reception of supporting pins 146.

Adjustable car supporting floors 148 slidably engage the uprights 142 and are adapted to be supported at different elevations by means of the pins 146. As thus arranged, it is clear that the vertical clearance or headroom of the cage can be varied to suit the height of the cars or other articles to be stored on the different supporting floors.

As clearly illustrated in the drawings, the floors 140 and 148 are provided with wheel pockets 150 and 152 adapted to accommodate, respectively, the rear and front wheels of the automobiles to be stored. Clearly with the wheels seated in such pockets or grooves, the cars will be held against dislodgment by their own weight.

The pockets 150 for the rear wheels may be deeper than the front pockets 152 so as to support the cars on the different floors in oppositely inclined position. This will permit of a saving in the space required between the adjustable floors of the cage and headroom will be gained for the load to be carried by the topmost floor.

Each car supporting cage may be provided with stops for preventing the over-travelling

of the car and the cages will be arranged so as to permit the accommodation of the longest car in common use on a carrier of minimum length. A suitable stop arrangement for preventing such over-travelling is illustrated in Fig. 19 in which the stop lugs 130 carried in guide hubs 132 are normally pressed upwardly by springs 134. A lever 136 and connections 138 are provided by means of which an operator can throw the blocks to inoperative position. Preferably, there will be a pair of blocks adapted to be elevated in front of the front wheels and to the rear of the rear wheels of the car. Various other suitable forms of stops may be provided for preventing over-travelling of the car on the cages.

The uprights 102 (Fig. 15) may be utilized to serve the same function as the guides 29 in Fig. 7 or such guides may be suitably secured to such uprights.

In the various embodiments of the invention illustrated, it is clear that I provide means whereby a maximum number of automobiles can be stored or accommodated in a minimum space. That is to say, in a given cubical space, I provide for storing a greater number of cars than could be stored by any device or structure heretofore in general use of which I am aware. This economy of space is made possible by closely aranging the cages on the supporting chain. The distance between the adjacent cages on the chain may be just sufficient to admit a car to the cage and permit the cages to clear one another when rounding the turn of the idlers, for example, as at the top in Fig. 4.

From a standpoint of economy of space, I find that a cage having a plurality of supporting floors such as illustrated in Fig. 6 has certain advantages over the cages having a single supporting floor and it is to be understood that I may use cages as in Fig. 6 having two, three or four floors as circumstances may deem expedient. By actual measurement and graphic layout, I have determined that in a height of 135 feet, twenty automobiles can be stored in cages of the single car type as shown in Fig. 1. As a basis for comparison with the cages such as shown in Fig. 6 having a plurality of supporting floors, I have worked out the heights required for the storage of twenty-four automobiles. On the basis of storage of twenty-four cars, I find that with the single cage arrangement of Fig. 1, a height of 161 feet 5 inches is necessary. With the arrangement of Fig. 6 having two storage floors per cage, the height required for twenty-four cars is 131 feet 6¾ inches. With a cage similar to Fig. 6 but having three supporting floors, twenty-four automobiles can be stored in a height of 126 feet. With a cage having four car supporting floors, a height of 127 feet 2 inches is necessary. With a cage similar to Fig. 6 but having six supporting floors, a height of 135 feet is required for the storage of twenty-four cars.

These figures are based on the assumption that the runs 10^a and 10^b of the chain will be as close together as possible and yet allow sufficient space to permit the cages to pass one another freely without chance for interference.

From the foregoing it is clear that a cage similar to Fig. 6 but having three supporting floors is perhaps the most economical from the standpoint of economy of space. This holds good where each supporting floor carries only one automobile. Where each cage carries two cars alongside of one another and each cage is provided with only a single supporting floor, I find that twenty-four cars can be stored in the height of 123 feet.

While I have described quite specifically various details of the embodiments of the invention illustrated, it is not to be construed that I am limited thereto since various modifications may be made by those skilled in the art without departing from the invention as defined in the appended claim.

What I claim is:—

In an apparatus of the character described, a pair of spaced chains, a series of storage cages between said chains, cross-members bridging the space between said chains, said cages being suspended from said cross-members with freedom for pivotal movement about the axes thereof, and guide wheels and driving means for said chains, an enclosing structure for the apparatus having a doorway centered with said chains, the latter having certain links adapted to be detached when loading or unloading automobiles and means for engaging the chain and sustaining its load when such links are detached.

In witness whereof, I have hereunto signed my name.

THOMAS E. MURRAY.